

ANTS, DISTURBANCE AND REGENERATION IN EUCALYPT FORESTS

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Abstract

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In a pilot study, the activity of the seed-eating ant *Prolasius pallidus* increased following disturbance in *Eucalyptus regnans* forests. Seed removal experiments in *E. regnans* and *E. obliqua* forests indicate that seed-eating ants may have a significant impact on the success of forest regeneration.

Introduction

In Australia, many forest types are logged for timber, burnt and subsequently sown to revegetate the area. An example is the Mountain Ash (*Eucalyptus regnans*) forests which are logged primarily in the Otway Ranges and Central Highlands of Victoria. The disturbance caused by logging and subsequent burning may significantly affect the community structure of flora and fauna, including ants.

Ants world-wide may have important impacts on plants, both as seed dispersers and as seed predators (Andersen and Yen, 1985; O'Dowd and Gill, 1984). The ant fauna of Australia is exceptionally diverse and abundant. Of the 2000 or so species of ants in Australia few are seed harvesters (Campbell, 1982). *Melophorus*, *Meranoplus*, *Pheidole*, *Monomorium* and some *Rhytidoponera* species represent the majority of Australian seed-eating taxa. However, ants are probably the most important post-dispersal seed predators in Australian forests and their activity may have important consequences for regeneration of plants.

Few studies have examined the effect of logging and subsequent burning of forests on ants or on seed removal rates (Neumann, 1991). To address this issue we have commenced a study in which we are asking two major questions:

1. Does logging and fire affect the species richness and abundance of ants?
2. After disturbance, what effect do ants have on forest regeneration using seed broadcasting?

Does disturbance affect ants?

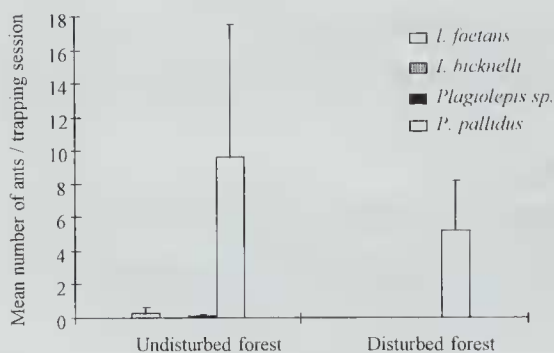
In a pilot study, we examined the abundance and species richness of ants in undisturbed *Eucalyptus*

regnans forests and at adjacent logged and burnt sites in the Central Highlands, Victoria.

Ten pitfall traps 2 cm in diameter were placed in two undisturbed *E. regnans* forests, two logged and burnt coupes and, at one site which was revegetated with *E. regnans* seeds three years previously. Pitfall traps were sampled after seven days, once during each season over one year at each site. *Prolasius pallidus*, a seed-eating ant, was the most abundant ant both at undisturbed and disturbed sites. *Iridomyrmex foetans* was present only at undisturbed sites, and *I. bicknelli* was present only at the revegetated site (Fig. 1). These preliminary results suggest that logging and burning affect the ant species composition and that species richness decreases with disturbance. Species richness of ants was particularly low, in contrast to other studies in different sites in the *E. regnans* forests of the Central Highlands (Neumann, 1992). Furthermore, ants were active throughout the year, and their species richness and relative abundance did not vary considerably from the data presented for Spring 1994.

We are currently conducting a more intensive survey of the effect of logging and fire on ant species richness and abundance. The study includes three *E. regnans* sites which were logged during Summer 1995–1996 and burnt in Feb 1996. At each site 20 pitfall traps placed along a 50 m transect are collected weekly and ant contents recorded. The mean number of ants for each species trapped at these sites will be compared to those from adjacent undisturbed plots both before and after logging, and after fire. So far, *P. pallidus*, is the most abundant ant trapped at each undisturbed site, however, the activity of this ant has increased after logging and post-fire to date, at each site. Also, ant species richness has declined from six species

A)



B)

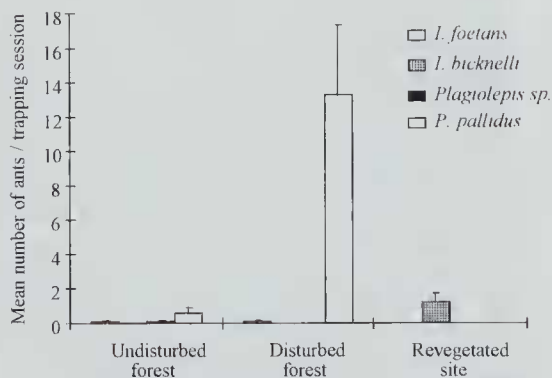


Figure 1. Mean number of ants trapped in pitfalls over 7 days ($n=10$, \pm SE), at A, site 1 in undisturbed and disturbed Mountain Ash forests and, at B, site 2, in undisturbed, disturbed and revegetated Mountain Ash forest during Spring 1994.

regularly trapped in undisturbed forest to two species; *P. flavicornis* and *P. pallidus*. *Prolasius pallidus* is believed to be an important seed predator in Mountain Ash forests in Victoria (Neumann, 1992).

What effect do ants have on forest regeneration?

Many studies have shown that the abundance of ants increases following fire. This increase in ant activity after a major habitat disturbance such as logging and fire may affect foraging rates on seeds. Seed-eating ants may have a particularly important impact on regeneration in areas which are being reafforested using broadcast seeds. In forests that are logged for timber and then burnt, seeds are sown directly onto the soil surface where they are available to ants.

Australian forestry services have used a variety of techniques to reduce seed removal or consumption by ants. Methods have included spraying insecticides in logged areas and their incorporation into clay pellets with seeds. Seeds have also been pelleted with clay to increase sowing accuracy of aerially broadcast seed.

In pilot studies, we examined whether seeds were removed by ants in *E. obliqua* and *E. regnans* forests and determined whether differences in removal rates occurred between pelleted and untreated seeds. Five replicates, each of ten pelleted and untreated seeds were placed onto perspex trays and covered with plastic coated wire umbrellas to protect seeds from rain. Significantly more pelleted *E. obliqua* seeds were removed than untreated seeds (Fig. 2). This may be explained by the high sugar content of the mucilage used to coat the clay to the seeds which may attract seed-eating ants.

However, when this experiment was repeated in a *E. regnans* forest the results were variable (Fig. 3). Slightly more pelleted and unpelleted seeds were removed from disturbed sites compared to undisturbed sites. Unseasonably poor weather conditions may have affected the

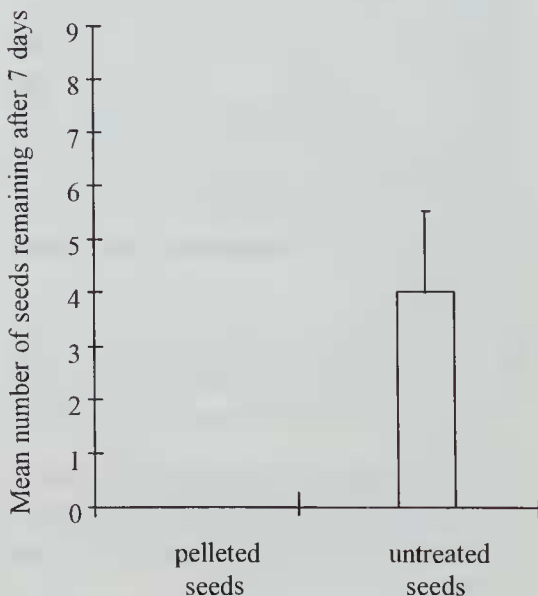


Figure 2. Mean number of pelleted and untreated *E. obliqua* seeds (\pm SE) remaining after 7 days in a Mess-mate forest. Significantly more pelleted seeds were removed compared to untreated seeds ($F_{1,28} = 19.7$, $P = 0.001$).

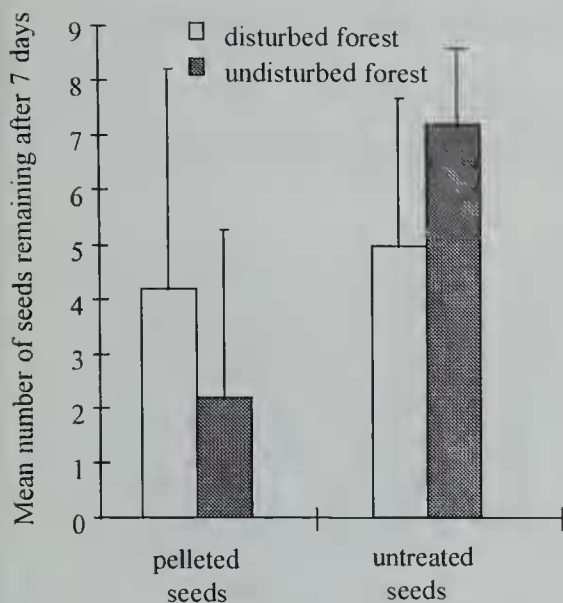


Figure 3. Mean number of pelleted and untreated *E. regnans* seeds (\pm SE) remaining after 7 days in a Mountain Ash forest.

results. If ants are attracted to pelleted seeds in other eucalypt forest types, this may have important implications for Australian forestry practices.

Further research

Logging, burning and subsequent seed broadcasting is commonly practiced by foresters in Australia. The effect this has on the removal rates of *E. regnans* seeds by ants in the Victorian Central Highlands will be examined. The main questions are:

1. After a forest is logged and burnt, do ants remove *E. regnans* seeds which are sown to revegetate the site?
2. *Prolasius pallidus* is the most abundant ant at each study site. This species is believed to be a seed-eating ant. If this species is active after major habitat disturbances, does it eat or remove broadcast seeds?
3. How is seed removal affected by different seed treatments (pelleted and untreated seeds) which are used in forestry practices?
4. Ants usually remove seeds from the soil surface. Covering seeds with a thin layer of soil may reduce access by seed-eating ants, thereby reducing seed removal rates. In addition, a thin layer of soil may actually

facilitate *E. regnans* seed germination. The effect of soil depth on removal germination of *E. regnans* seeds will be examined at logged, burnt sites and in the laboratory. This technique may lead to an increase in seed survival and germination success.

Summary

In Australian forests, ants are very diverse and abundant, and are considered the most important post-dispersal seed predators. Major habitat disturbances lead to an increase in surface activity which may consequently lead to an increase in seed removal rates.

Pilot studies have shown that ant abundances are affected to some degree by logging and fire, and that seeds are removed from logged and burnt sites. However, both activity and foraging rates are highly variable. Further studies will examine how disturbance affects ants, both before and after logging, and after fire.

So far, the potential impact of ants on regeneration success of eucalypts on logged and burned sites is unknown. However, the effects of ants on revegetation of logged areas may have important implications for future forest regeneration techniques used throughout Australia.

Acknowledgements

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